User Manual
iGS-221

INTEGRATED CONTROLLER
TEMPERATURE, HUMIDITY AND CO_2

To manage all garden's climate parameters!

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Recommended equipments
for an optimal use of the iGS-221

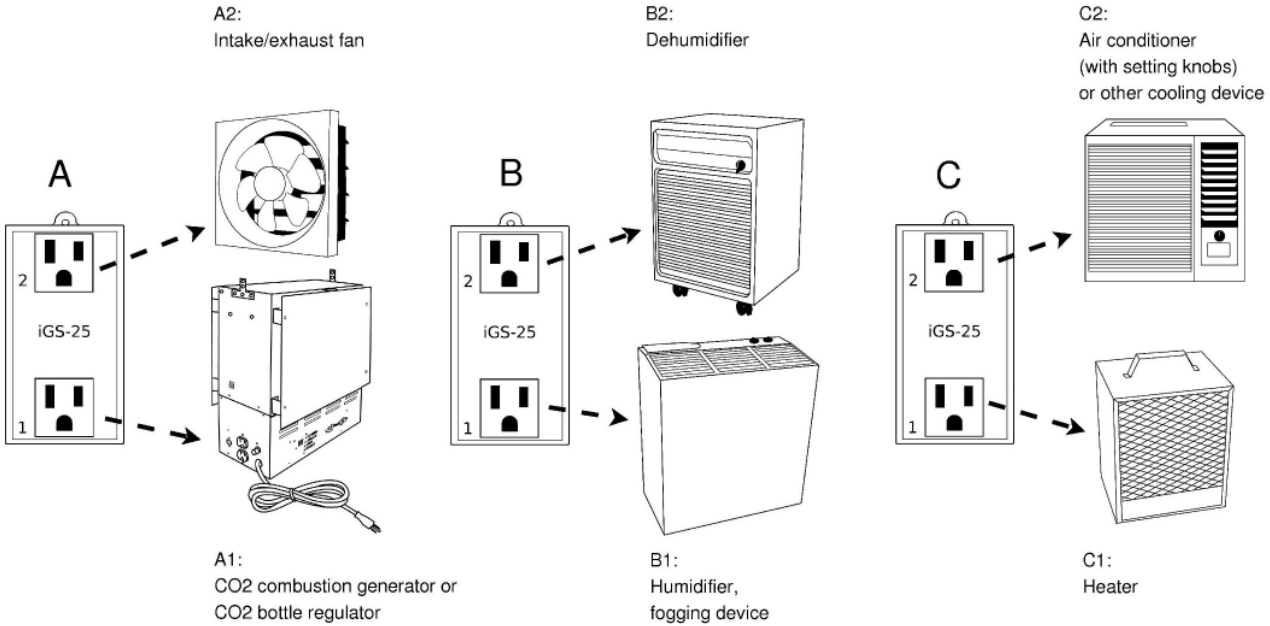

TABLE OF CONTENTS

1. Description 2
2. Connection and Installation 2
Components 2
Connection Scheme 3
Connection Instructions 4
Recommanded Equipments for an Optimal Use of the iGS-221 4
Using only the ventilation to cool and dehumidify the garden 5
Connecting an Alarm System 5
Installation and Security Notice 5
3. Settings Ajustement 6
Control Panel Description 6
Initialization 7
Carbon Dioxide Settings Adjustment [ppm CO_2] 7
Relative Humidity Settings Adjustment [% RH] 10
Temperature Settings Adjustment [Temp °C / °F] 12
Manual Activation of the Emergency Ventilation 14
Time Clock Setting 14
Differential 15
24 Hours Log 16
Alarm 17
4. Sequence of Actions 19
Table of Sequence of Actions 19
Questions and Answers of Action Priorities Management Strategy 20
5. Displayed Messages and Solutions 21
Information Messages (*advice*) 21
Error Messages 22
Alarm Messages 22
Reset Procedure 22
6. Sensors Calibration 23
CO_2 Sensor Calibration 23
Relative Humidity and Temperature Sensors Calibration 25
7. Security and Maintenance 26
Air Filter 26
Sulphur Evaporation 26
Water Splashing 26
Electrical Specifications 27
8. Warranty 28
Step-By-Step Warranty and Repairs Implementation 28

1. DESCRIPTION

PLUG'N'GROW's iGS-221 combines precision and simplicity!

ONLY ONE *controller to manage* ***ALL*** *indoor garden's climate parameters!*

- Simultaneously controls temperature, relative humidity and CO_2 concentration;
- Intelligently manages 6 actions: generating CO_2, venting, humidifying, dehumidifying, heating and cooling;
- Prioritizes actions according to a logical sequence; allowing the plants to keep their stomas opened for an optimal CO_2 absorption;
- Up to 45 amps of controlled equipments (110-120V);
- Automatic differential for a precise CO_2 concentration control;
- Ready to use, just adjust your set points;
- Avoids contradictory actions (e.g.: cooling and heating);
- Emergency ventilation against extreme temperature or humidity
- A log to know your garden's conditions in the last 24 hours;
- Hassle free 3 years warranty;
- 6 days a week free technical support.

novabiomatique.com

2. CONNECTION AND INSTALLATION

COMPONENTS

1 control module

1 connection module

3 iGS-25

1 AC adaptor

4 Ethernet cables (RJ45)

1 spare filter

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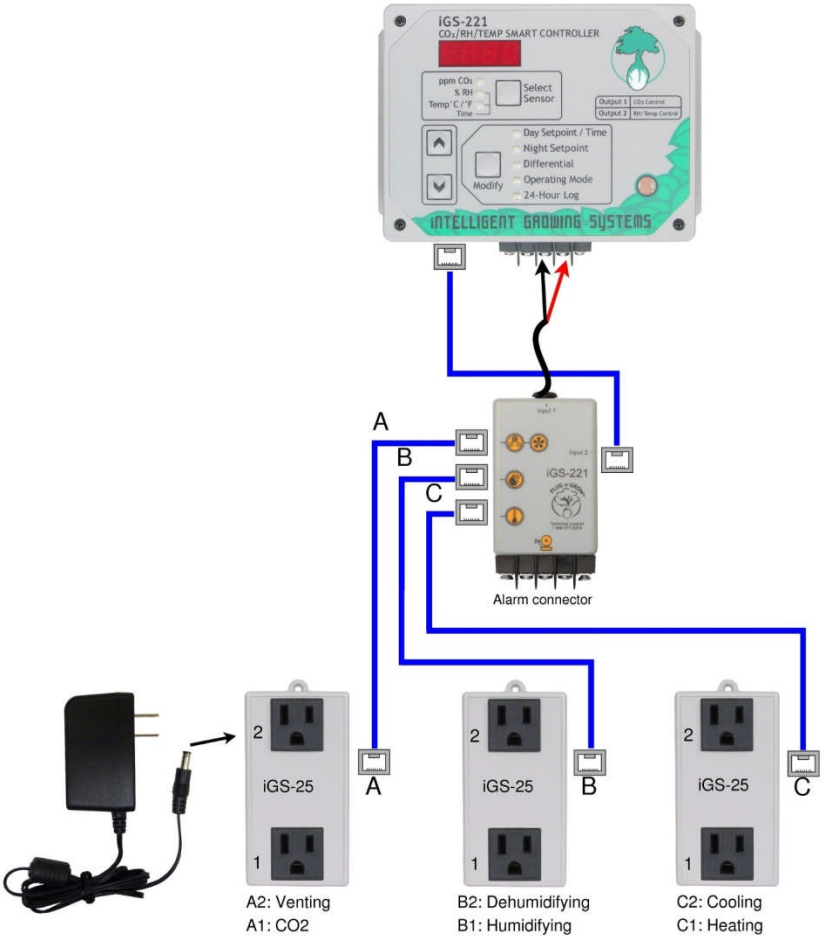
CONNECTION SCHEME

For more details, please refer to Quick Setup Guide.

CAUTION	THE EQUIPMENT(S) PLUGGED TO THE IGS-25 OUTLETS AND CONTROLLED BY THE IGS-221 MUST HAVE THEIR OWN OVERHEATING PROTECTION BREAKER OR APPROPRIATE DEVICE



CONNECTION INSTRUCTIONS

CONNECTING THE CONTROL MODULE TO THE CONNECTION MODULE

- Connect the two wires cable from the connection module (*Input 1*) to the control module's terminal block. The red wire connected to the right terminal; the black wire to the middle terminal.
- Connect one of the Ethernet cable's (RJ45) male connector into the female connector located underneath the control module and the other male connector in the connection module's female connector (*Input 2*).

CONNECTING THE CONNECTION MODULE TO EACH IGS-25

- Connect one male connector of each Ethernet cable into the connection module's female connectors (A, B, C).
- Connect the other male connector of the Ethernet cables into each iGS-25.

An iGS-25 can be replaced by an iGS-50 or the reverse. The A connector from the connection module supplies the control module with electricity. The iGS-25 linked to the A connector must be connected to an AC adaptor (see scheme page 3). The iGS-50 linked to the A connector does not require an AC adaptor.

CONNECTING THE EQUIPMENTS TO EACH IGS-25

- Connect the equipments to the iGS-25 following these indications and looking at the schematic on page 3.

Output A1: CO_2 equipment
Output A2: Ventilation equipment
Output B1: Humidifying equipment
Output B2: Dehumidifying equipment
Output C1: Heating equipment
Output C2: Cooling equipment

Equipments which use other voltage then 110-120V may be controlled by the iGS-221 by using an **iGS-DCS** (see page 29).

RECOMMENDED EQUIPMENTS FOR AN OPTIMAL USE OF THE IGS-221

It is recommended to use the following equipments for an optimal control:

Output A1: CO_2 combustion generator or CO_2 bottle regulator
Output A2: Intake/exhaust fan
Output B1: Humidifier, fogging device
Output B2: Dehumidifier
Output C1: Heater
Output C2: Air conditioner (with rotary controls) or other cooling device*

* Air conditioner with a built in digital keyboard cannot be controlled by the iGS-221 unless it has an "Auto restart" feature that will restart the unit after a power failure: a few known models are (see list on novabiomatique.com):

- Home Essentials 13,000 BTU Portable Air Conditioners SU AC PH13
- Comfort Cool Dual Hose 11,000 BTU Port. Air Conditioner SN AC W1140D
- Home Essentials Premium 10,000 BTU Portable Air Conditioner
- AutoCool 12,000 BTU Portable Air Conditioners SU AC PH12

For an AC unit without “Auto restart”, plug it independently from the iGS-221 and set both the air conditioner and the iGS-221 to the desired garden temperature. A temperature sensor’s calibration is suggested on your iGS-221 so both devices have equivalent temperature readings (see *Relative humidity and temperature sensors calibration* on page 25). If the air conditioner breaks down or looses power from its circuit, the iGS-221 may activate the intake /exhaust fan(s) as an emergency measure to limit the temperature increase (See *Use ventilation to limit excessive temperature* on page 13). Do not plug any equipment in Output C2 (air conditioner) as this output might be ON at the same time as the CO_2 enrichment, humidifying or dehumidifying equipments.

USING ONLY THE VENTILATION TO COOL AND DEHUMIDIFY THE GARDEN

In cold winter conditions or if the garden is operated during the night when the outside air is colder, the iGS-221 may provide sufficient cooling using the ventilation. Just set the iGS-221 temperature (°C / °F) [Day Setpoint] 3**°C** or 5**°F** lower than the desired garden temperature (page 12). Also set the temperature [Operating Mode] to “FC Y” (Fan Control = Yes, see page 13: *Use ventilation to limit excessive temperature*)

Also, with outside colder and dryer air, the iGS-221 may provide sufficient dehumidification using the intake/exhaust fan(s) plugged into output A2. Just set the iGS-221 Relative Humidity [Day Setpoint] 3**%** lower than the desired garden humidity (page 11). Also set the Relative Humidity [Operating Mode] to “FC Y” (Fan Control = Yes, see page 11: *Use ventilation to limit excessive humidity*)

CONNECTING AN ALARM SYSTEM

The iGS-221 allows the connection to an alarm system. See the *Alarm* section on page 17 for more information.

INSTALLATION AND SECURITY NOTICE

DANGER: *To reduce risks of fire hazards or electrical shocks, attentively read the following instructions before powering the system with electricity.* THE EQUIPMENT(S) PLUGGED TO THE IGS-25 OUTLETS AND CONTROLLED BY THE IGS-221 MUST HAVE THEIR OWN OVERHEATING PROTECTION BREAKER OR APPROPRIATE DEVICE

SAFE INSTALLATION OF THE IGS-25

All iGS-25 have to be plugged in a 120V-15 A outlet. Each iGS-25 can support a maximal load of 15 A. In order to take advantage of 15 A for each iGS-25, **it is important to use 3 electrical outlets on 3 separate electrical circuits**. The equipments’ total load must not exceed the electrical circuit capacity.

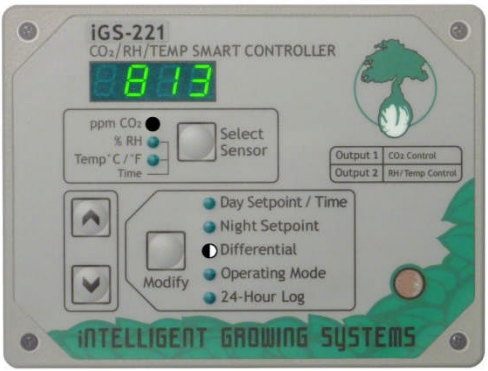
SAFE INSTALLATION OF THE CONTROL AND THE CONNECTION MODULES

The control module must be fixed to a vertical wall with 4 screws. Locate the control module at the plants’ height and at a representative location for the conditions’ measurements. Also, the light sensor (photocell), located in the bottom right corner, must be able to detect the presence or absence of light.

The connection module also must be fixed on a vertical wall with 2 screws. For a long distance connection, it is possible to replace the cables linking the iGS-25 and the connection module with other Ethernet cables with a maximal length of 50 feet. **However, it is not recommended to use a cable longer than the one included between the control module and the connection module**.

3. SETTINGS AJUSTEMENT

CONTROL PANEL DESCRIPTION



● Steady Light ◐ Flashing Light

4 digits display:
The display shows different data: current room conditions, time, control module's settings and more.

3 climate parameters:

- [ppm CO_2] (CO_2 concentration)
- [% RH] (Relative humidity)
- [Temp °C / °F] (Temperature)

5 applicable functions for each climate parameter:

- [Day Setpoint / Time]
- [Night Setpoint]
- [Differential]
- [Operating Mode]
- [24-Hour Log]

4 keys for selection:

- SELECT SENSOR: Repeatedly press this key to select a parameter.
- MODIFY: Repeatedly press this key to select a function.
- UP and DOWN ARROWS: Press to modify current value shown on the display (optional to some menus or operating modes): hold down the key for a faster scroll of the values.

Light indicators:
Light indicators are placed beside each parameter or function and are on (lit) when a parameter or function is selected. In some cases, the light indicators might flash.

Light sensor:
The control module has a built in sensor to detect the presence or absence of light. Depending on the plant's needs, the set point for light [Day Setpoint/Time] and dark [Night Setpoint] periods may be different for each parameter.

INITIALIZATION

When the controller is initialized, the following elements appear on the display:

- The model (e.g.: P221) followed with the controller's version (e.g.: S1.10);
- Then, the time followed by an informative message (Adv), indicating that the controller was unplugged for a while. For more information, see the *Displayed Messages and Solutions* section on page 21.

Take note that after the initialization, the controller will take approximately 30 seconds before getting a CO_2 measurement; a countdown is displayed when [ppm CO_2] is selected. The equipments' activation starts only after this 30 seconds countdown.

CARBON DIOXIDE SETTINGS ADJUSTMENT [PPM CO_2]

To adjust the set points for this parameter [ppm CO2], repeatedly press SELECT SENSOR until the light indicator is on at [ppm CO2].

The display shows the current CO_2 measurement. A flashing display means that an output associated with this parameter is active.

To adjust the functions related to CO_2, press MODIFY. The light indicator is on at the selected function.

[DAY SET POINT]

CO_2 concentration (ppm) adjustment during light period

Once the light indicator is on at [Day Setpoint]:

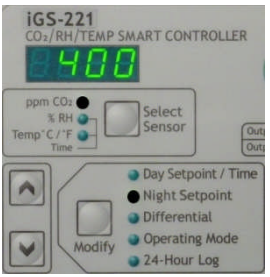
- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[NIGHT SETPOINT]

CO_2 concentration (ppm) adjustment during dark period

Once the light indicator is on at [Night Setpoint]:

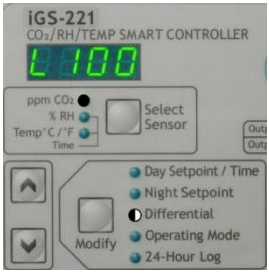
- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.



Differential adjustment

The iGS-221 has a dynamic differential that is automatically self-adjusting to the growing environment. It is recommended to use this type of differential for CO_2 control and to resort to manual adjustment only if the differential's functioning is not satisfactory.

For more information, see the Differential section on page 15.



Once the light indicator is on at [Night Setpoint]:

- Press MODIFY again and hold the key until the letter "L", followed by a numerical value, appears on the display (approximately 3 seconds). The light indicator will flash at [Differential].
- To adjust the low differential (L), press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values. Press MODIFY to save the modification and continue with the high differential (H) adjustment.
- Press the ARROW keys to modify the high differential's current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[DIFFERENTIAL]

This function is not active on the iGS-221. Do not take the displayed value in consideration.

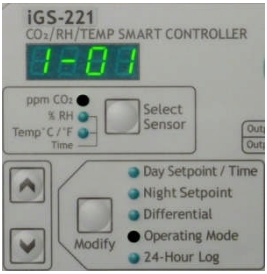
[OPERATING MODE]

Differential type setting

There are two types of differential for CO_2 control:

1-01: Dynamic differential
1-02: Fixed differential

For more information, see the Differential section on page 15.



Once the light indicator is on at [Operating Mode]:

- Press the ARROW keys to modify the differential type.
- Press MODIFY to save the modification and continue to the next function.

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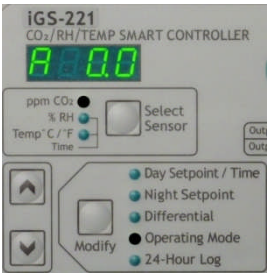
Altitude adjustment

The precision on the CO_2 concentration measurement is affected by the altitude; the concentration measurement drifts from the true value with altitude elevation. To assure a precise measure, it is recommended to adjust the controller to the garden site altitude relative to sea level.



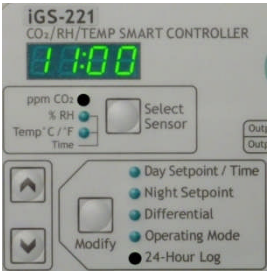
Once the light indicator is on at [Operating Mode]:

- Press MODIFY again; the letter "A" (for altitude), followed by a numerical value, appears on the display.
- Press the ARROW keys to modify the current value (0.5 = 500 feet / 0 = sea level).
- Press MODIFY to save the modification and continue to the next function.

[24-HOUR LOG]

Access to the 24 hours log

For more information, see the 24 Hours Log section on page 16.



Once the light indicator is on at [24-Hour Log]:

- The display shows a definite time (clock) and the following elements for that specific time:
  - "Lo", followed by a numerical value corresponding to the lowest CO_2 concentration measurement.
  - "avg", followed by a numerical value corresponding to the average CO_2 concentration measurements.
  - "Hi", followed by a numerical value corresponding to the highest CO_2 concentration measurement.
- Press the DOWN ARROW key to go back in the last 24 hours, or the UP ARROW key to go up to the most recent information.
- Press MODIFY to quit this function.

Ventilation cycle

New oxygen is needed in an indoor garden for the roots to uptake the nutrients and to replenish the oxygen supply to provide a clean and safe combustion with CO_2 generators ("burners"): if the oxygen level gets too low, carbon monoxide poisonous to humans and acetylene poisonous to plants will also get generated. With a combustion CO_2 generator, new air intake in the garden is clearly needed and can be cyclical. Carbon dioxide does not "corrode" or "rot" and does not loose its properties over time. So, with the use of bottled CO_2 and a regulator to enrich the garden atmosphere, ventilation is not required.

iGS-221 provides a ventilation cycle adjustment from 0 to 30 minutes per hour. When activated "CF" for "Cyclical Fan" displays alternately with the selected sensor reading (see page 15).

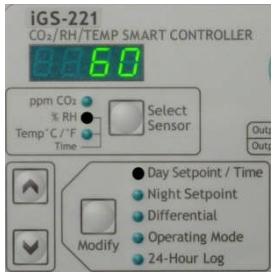
RELATIVE HUMIDITY SETTINGS ADJUSTMENT [% RH]

To adjust the set points for this parameter [% RH], repeatedly press SELECT SENSOR until the light indicator is on at [% RH].

The display shows the current relative humidity measurement. A flashing display means that an output associated with this parameter is active.

To adjust the functions related to relative humidity, press MODIFY. The light indicator is on at the selected function.

[DAY SETPOINT]

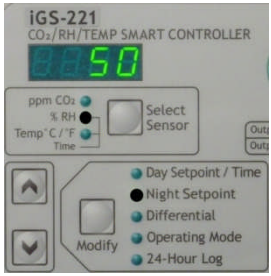


Relative humidity (%) adjustment during light period

Once the light indicator is on at [Day Setpoint]:

- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[NIGHT SETPOINT]



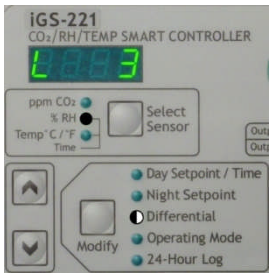
Relative humidity (%) adjustment during dark period

Once the light indicator is on at [Night Setpoint]:

- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

Differential adjustment

For more information, see the Differential section on page 15.



Once the light indicator is on at [Night Setpoint]:

- Press MODIFY again and hold the key until the letter “L” (low), followed by a numerical value, appears on the display (approximately 3 sec.). The light indicator will flash at [Differential].
- To adjust the low differential (L), press the ARROW keys to modify the current value. Press MODIFY to save and continue with the high differential (H) adjustment.
- Press the ARROW keys to modify the high differential’s current value.
- Press MODIFY to save the modification and continue to the next function.

[DIFFERENTIAL]

This function is not active on the iGS-221. Do not consider the displayed value.

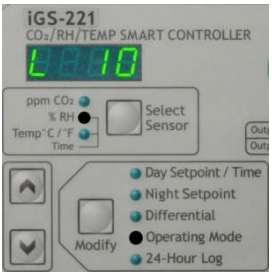
[OPERATING MODE]

Use ventilation to limit excessive humidity

- Once the light indicator is on at [Operating Mode]: “FC_?” for “FAN CONTROL”. appears on the display.
- Using either ARROW keys toggle “FC n” for no control or to “FC Y” to have the fan(s) activated if the relative humidity gets too high.
- Press MODIFY to save the modification and continue with the relative humidity’s alarm low limit (L) adjustment.

Alarm – Relative humidity’s low and high limits adjustment

For more information, see the Alarm section on page 17.



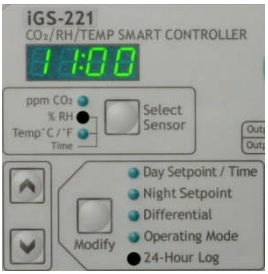
- The letter “L”, followed by a numerical value, appears on the display.
- To adjust the relative humidity’s low limit (L), press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values. Press MODIFY to save the modification and continue with the relative humidity’s high limit (H) adjustment.
- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[24-HOUR LOG]

Access to the 24 hours log

For more information, see the 24 Hours Log section on page 16.

Once the light indicator is on at [24-Hour Log]:



- The display shows a definite time (clock) and the following elements for that specific time:
  - “Lo”, followed by a numerical value corresponding to the lowest relative humidity level measurement.
  - “avg”, followed by a numerical value corresponding to the average relative humidity level measurements.
  - “Hi”, followed by a numerical value corresponding to the highest relative humidity level measurement.
- Press the DOWN ARROW key to go back in the last 24 hours or the UP ARROW key to go up to the most recent information.
- Press MODIFY to quit this function.

TEMPERATURE SETTINGS ADJUSTMENT [TEMP °C / °F]

To adjust the set points for this parameter [Temp °C / °F], repeatedly press SELECT SENSOR until the light indicator is on at [Temp °C / °F].

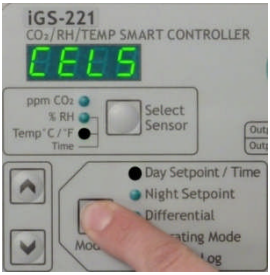
The display shows the current temperature measurement. A flashing display means that an output associated to this parameter is active.

To adjust the functions related to temperature, press MODIFY. The light indicator is on at the selected function.

Changing the temperature units: Celsius or Fahrenheit

Once the light indicator is on at [Temp °C / °F]:

- Repeatedly press the MODIFY key until all light indicators are off in the functions menu.
- Press MODIFY again and hold down the key until “CELS” or “FAHr” appears on the display.
- Release the key to activate the new temperature unit. If “CELS” appeared on the display, unit is now in Celsius; if “FAHr” appeared, unit is now in Fahrenheit.
- Repeat steps above to alternate between units.

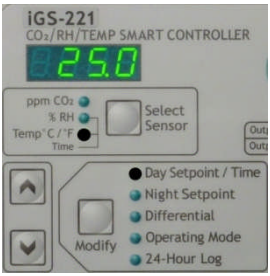


[DAY SETPOINT]

Temperature (°C / °F) adjustment during light period

Once the light indicator is on at [Day Setpoint]:

- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.



[NIGHT SETPOINT]

Temperature (°C / °F) adjustment during dark period

Once the light indicator is on at [Night Setpoint]:

- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

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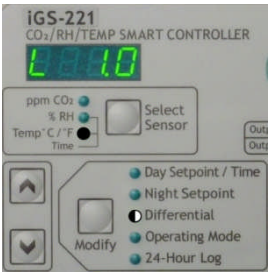
Differential adjustment

For more information, see the Differential section on page 15.



Once the light indicator is on at [Night Setpoint]:

- Press MODIFY again and hold down until the letter "L", followed by a numerical value, appears on the display (approximately 3 seconds). The light indicator will flash at [Differential].
- To adjust the low differential (L), press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values. Press MODIFY to save the modification and continue with the high differential (H) adjustment.
- Press the ARROW keys to modify the high differential's current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[DIFFERENTIAL]

This function is not active on the iGS-221. Neglect the displayed value.

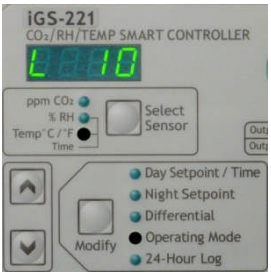
[OPERATING MODE]

Use ventilation to limit excessive temperature

- Once the light indicator is on besides [Operating Mode]: "FC_?" for "FAN CONTROL" appears on the display.
- Using either ARROW keys toggle "FC n" for no control or to "FC Y" to have the fan(s) activated if the temperature gets too high.
- Press MODIFY to save the modification and continue with the temperature alarm low limit (L) adjustment.

Alarm – Temperature's low and high limits adjustment

For more information, see the Alarm section on page 17.

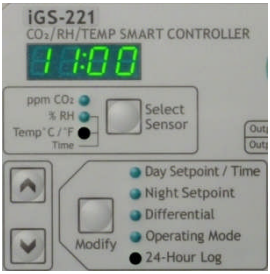


- The letter "L", followed by a numerical value, appears on the display.
- To adjust the temperature's low limit (L), press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values. Press MODIFY to save the modification and continue with the temperature's high limit (H) adjustment.
- Press the ARROW keys to modify the current value; hold down the key for a faster scroll of the values.
- Press MODIFY to save the modification and continue to the next function.

[24-HOUR LOG]

Access to the 24 hours log

For more information, see the 24 hours log section on page 16.



Once the light indicator is on at [24-Hour Log]:

- The display shows a definite time (clock) and the following elements for that specific time:
  - o "Lo", followed by a numerical value corresponding to the lowest temperature level measurement.
  - o "avg", followed by a numerical value corresponding to the average temperature level measurements.
  - o "Hi", followed by a numerical value corresponding to the highest temperature level measurement.
- Press the DOWN ARROW key to go back in the last 24 hours or the UP ARROW key to go up to the most recent information.
- Press MODIFY to quit this function.

MANUAL ACTIVATION OF THE EMERGENCY VENTILATION

The manual activation of the ventilation is a safety feature. If someone entering the garden experiences a discomfort such as dizziness, sudden drowsiness or nausea, the CO_2 concentration could be too high. Anyone should leave the garden or manually activate the ventilation to reduce the CO_2 concentration.

- Press and hold SELECT SENSOR (approximately 5 seconds) to activate the ventilation (output A2).
- To deactivate, repeat the same procedure above.

Note that all other equipments will be turned off when the emergency ventilation is activated; they resume their normal functioning when the emergency ventilation is deactivated.

TIME CLOCK SETTING

The controller does not rely on clock to operate but rather on light and dark periods detected from the light sensor (photocell). The accuracy of the time on the clock does not affect the controller's proper functioning.

However, time setting is essential for a good 24 hours log interpretation.

For more information, see the 24 Hours Log section on page 16.

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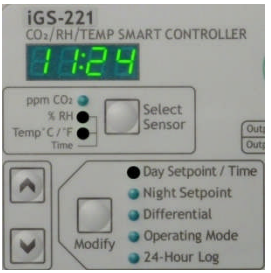
To set the time



- Repeatedly press SELECT SENSOR until the light indicators are simultaneously on at [% RH] and [Temp °C / °F].
- Press MODIFY to select [Day Setpoint / Time].
- Press the UP ARROW key to set the hours; hold down the key for a faster values scroll.
- Press the DOWN ARROW key to set the minutes; hold down the key for a faster scroll.
- Press MODIFY to save the settings and proceed to the cyclical fan setting

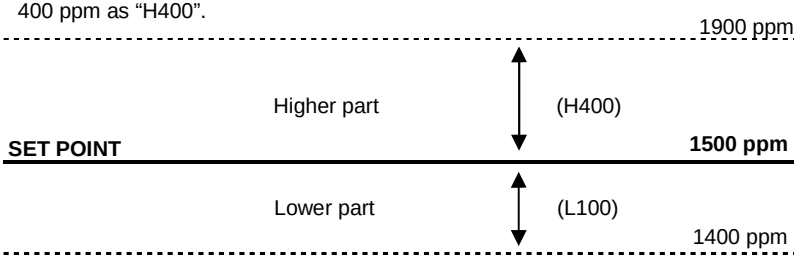
Please note that the controller uses a 24 hour clock (e.g.: 13:00 = 1:00 pm).

To set the cyclical fan

- When the light indicator is on besides [Operating Mode], CF:NN displays.
- Press either ARROW key to set the desired cyclical fan functionning per hour: adjustable from 0 to 30 minutes per hour (0 minute = no Fan cycle)
- Press MODIFY to save the setting and exit the settings menu

DIFFERENTIAL

The iGS-221 differential represents the climate's variation around the set point. In other words, the differential is the range between the values at which the controller shuts off an equipment and at which the controller turns on the opposite action equipment (e.g.: heater and air conditioner). The differential contains an inferior part and a superior part from the set point. To ease the display's reading, the inferior differential (Low) is identified with an "L" and the superior differential (High) is identified with an "H". For example, an inferior differential of 100 ppm will display as "L100" and a superior differential of 400 ppm as "H400".



There are two types of differential:

- **Fixed differential**: the controller uses fixed low and high differential values, modifiable by user.
- **Dynamic differential** (optimised by the controller): the controller automatically modifies the inferior and superior differential's values to narrow the differences around the set point.

For the CO_2, it is possible to choose the type of differential. However, **it is recommended to use the dynamic differential** for this parameter's control. For temperature and relative humidity, the differential is always fixed.

Dynamic differential: recommended for CO_2 control

After each ON cycle of an equipment used for CO_2 concentration control, the controller compares the value obtained with the set point. If the difference is too important (set point has not been reached or has been exceeded), the controller modifies its differential to minimize the difference at the next ON cycle. In brief, the controller analyses the previous actions and adjusts itself in order to be as close as possible to the set point, allowing optimal CO_2 control in your garden environment.

The dynamic differential is the default setting for CO_2 control

To modify the differential type, see the *Differential Type Setting* section on page 8.

The recommended differential value for CO_2 is 100 ppm (L100) for the low differential and 400 ppm (H400) for the high differential. To modify the differential, see the *Differential Adjustment* section on page 8.

Fixed differential: recommended for relative humidity and temperature control

For temperature control, the recommended differential value for low and high differentials is 1.0 °C (1.8 °F): “L1.0” and “H1.0” in Celsius and “L1.8” and “H1.8” in Fahrenheit. For the relative humidity control, the recommended differential value for the low and high differentials is 3 %: “L3” and “H3”. However, you can modify these values to better suit your garden’s environment.

Using a differential avoids an equipment turning on at the same time as the opposite action equipment turns off (e.g.: heater and air conditioner). Generally, a small differential allows more stable conditions but can also cause waste of energy and wear off the equipment faster. It is important to find the right settings. Trial and error is the only sensible procedure to find out.

When “Fan Control” is used to limit high relative humidity (pages 5 an 11) or to limit high temperature (pages 5 and 13), the fan(s) is (are) activated at “RH Day Setting + fixed differential + 3%RH or at Temperature Day Setting + fixed differential + 1°C (1.8 °F) respectively.

24 HOURS LOG

The 24 hours log is useful for:

- detecting defective equipments or intermittent problems;
- knowing your garden’s conditions in the last 24 hours;
- following climatic conditions to learn more about plants.

The 24 hours log keeps in memory the measured values during the last 24 hours. The controller calculates for every one hour period the minimum (“Lo”), the maximum (“Hi”) and the average (“avg”) measurements for each parameter (CO_2, % RH, Temp). The displayed values represent the measurements taken in the hour preceding the one displayed (e.g.: 23:00 = measurements between 10:00 pm and 11:00 pm).

It is important to set the time on your controller to get the log’s information synchronised with real time (see *Time Clock Setting* section on page 14). To get access to the 24 hours log, see pages 9, 11 and 14 in the *Settings Adjustment* section.

ALARM

In order to be informed of any problem with the relative humidity or temperature control, it is possible to designate low and high limits for these parameters to trigger the alarm of the iGS-221. As soon as the ambient conditions drop down lower than the low limit or exceed the high limit, the alarm will be activated: a message (Alr X) will be displayed and the dry contact on the alarm connector (connection module) will be activated as well. To fully take advantage of these alarm options, the iGS-221 must be connected to a compatible alarm system (0.6 A @ 120 Vac or 2A @ 30 Vdc), such as the PLUG'N'GROW automatic dialer iMS-100 (not included).

TWO ALARM MODES AVAILABLE

Mode A

Safe connection - triggers the contact when any of these three conditions is met:

- A power outage, a power supply or any component failure;
- A sensor or memory failure;
- Ambient conditions have reached the relative humidity or temperature's low or high limits.

Mode B

Regular connection - triggers the contact when any of these two conditions is met:

- A sensor or memory failure;
- Ambient conditions have reached the relative humidity or temperature's low or high limits.

Mode B is not a safe connection. If the alarm relay or triggering circuit fails, the alarm might not be transmitted.

Alarm system connection

- Unplug the controller.
- The alarm connector is located underneath the connection module. Referring to the picture, connect the alarm system's wires to the terminal corresponding to the selected mode (Mode A = terminal Com + A; Mode B = terminal COM + B).
- Plug the controller.

Alarm mode adjustment (A or B)

- Repeatedly press the SELECT SENSOR key until the light indicator is on at [Temp °C / °F] or [% RH].
- Repeatedly press the MODIFY key until the light indicator is on at [Operating Mode]. The letter “L”, followed by a numerical value, is displayed.
- Press MODIFY again and hold down the key until the letter “A” or “b” appears on the display (mode A or B). The light indicator is flashing at [Operating Mode].
- Press the ARROW keys to select the alarm mode.
- Press MODIFY to save the modification and continue to the next function.
- To quit, repeatedly press MODIFY until all light indicators are off in the functions menu.

To modify the relative humidity’s low and high limits, see the section *Alarm – Relative humidity’s high and low limits adjustment* on page 11.

To modify the temperature’s low and high limits, see the section *Alarm – Temperature’s high and low limits adjustment* on page 13.

To deactivate the iGS-221’s alarm functions, adjust the relative humidity and temperature’s low and high limits to values that will never be reached and that are different than 0.

CAUTION	THE EQUIPMENT(S) PLUGGED TO THE IGS-25 OUTLETS AND CONTROLLED BY THE IGS-221 MUST HAVE THEIR OWN OVERHEATING PROTECTION BREAKER OR APPROPRIATE DEVICE

4. SEQUENCE OF ACTIONS

To control the different equipments plugged in the iGS-25, the iGS-221 uses a non modifiable internal programming. This programming allows the controller to intelligently manage the 6 equipments, prioritizing a logical sequence of actions.

The following table sums up many possible situations and the outputs that will be activated in each case. The controller constantly monitors the situation and chooses the correct action as needed.

TABLE OF SEQUENCE OF ACTIONS

Outputs	Actions
A1	CO_2 enrichment
A2	Ventilation
B1	Humidifying
B2	Dehumidifying
C1	Heating
C2	Cooling

*Output A2 for ventilation is activated only if cyclical ventilation ("CF" displays: setting from 0 to 30 minutes per hour) or if temperature gets too high ("FC T" displays) or relative humidity gets too high ("FCrH" displays).

	ACTIVATED OUTPUTS		
Actions	**Immediate activation**	**Activation after 5 min**	**Activation after 10 min**
CO_2 enrichment	A1		
Humidifying	B1		
Dehumidifying	B2		
Heating	C1		
Cooling	**C2**		
CO_2 enrichment, humidifying	A1	B1	
CO_2 enrichment, dehumidifying	B2	A1	
CO_2 enrichment, heating	A1	C1	
CO_2 enrichment, cooling	C2	A1	
Humidifying, heating	B1, C1		
Humidifying, cooling	C2	B1	
Dehumidifying, heating	C1	B2	
Dehumidifying, cooling	C2	B2	
CO_2 enrich., humidifying, heating	A1	C1	B1
CO_2 enrich., humidifying, cooling	A1, C2	B1	
CO_2 enrich., dehumidify, heating	C1	B2	A1
CO_2 enrich., dehumidifying, cooling	B2, C2	A1	
Lower CO2 concentration in the dark (promotes transpiration)	A2		
Ventilation cyclical	**A2**		
Alternative cooling – ventilation	**A2**		
Alternative dehumidification – ventilation	**A2**		

Example:

Dehumidifying, heating: C1 —5 min→ B2

In a growing environment, the relative humidity level is too high and the temperature is too low; the iGS-221 is in a situation where it needs to dehumidify and heat. First, the controller will activate the heating equipment (C1). If the desired temperature is not reached after 5 minutes and the heat has not allowed to dehumidify enough, the dehumidifying equipment (B2) will be activated (working at the same time as the heating equipment) until the desired humidity level is reached.

Oppositely, if the desired temperature is reached after 3 minutes only, and the humidity level is still too high, the heating equipment (C1) will shut off and the dehumidifying equipment (B2) will immediately be activated.

QUESTIONS AND ANSWERS - ACTION PRIORITIES MANAGEMENT STRATEGY

Why activating the CO_2 enrichment first when CO_2 enrichment and humidifying is necessary?

It is common to use a propane or natural gas combustion CO_2 generator to produce CO_2. The combustion produces CO_2 and water vapour, augmenting the humidity level in the atmosphere. When enriching the atmosphere with CO_2 first, the humidity level could be corrected at the same time.

Why use cyclical ventilation?

Venting a garden with fresh air from time to time provides the necessary oxygen needed by plants as well as the CO_2 generator. It allows complete combustion in the generator which produces water and, of course, CO_2. On the other hand, a lack of oxygen prevents complete gas combustion; ethylene (harmful to plants) and carbon monoxide (CO: potentially lethal for humans) are then released. We estimate that a 2 minutes per hour fan activation is sufficient to replenish the oxygen needed for a clean gas combustion.

5. DISPLAYED MESSAGES AND SOLUTIONS

INFORMATION MESSAGES (*ADVICE*)

Code	Cause	Effects on controller	Solution
Adv 1	The CO_2 measurement exceeds 5000 ppm.	Ventilation (output A2) is activated until the CO_2 concentration drops below 5000 ppm. Then, the message disappears.	If the CO_2 sensor's measurement seems false, it is possible to calibrate it. See *CO_2 Sensor Calibration* section on page 23.
Adv 2	The last CO_2 sensor's calibration has been done over a year ago. A calibration is recommended.	The controller continues its normal functioning. The message disappears as soon as a calibration is done.	You need to calibrate the CO_2 sensor. See *CO_2 Sensor Calibration* section on page 23.
Adv 3	Automatic system recovery has completed successfully after intermittent fault.	The message disappears by pressing MODIFY key.	Verify your settings to validate that the recovered data are exact to your adjustments.
Adv 6	The system has restarted after a short power outage of less than 2 hours.	At power on, the time is displayed. The message disappears by pressing the MODIFY or SELECT SENSOR key. The 24 hours log has been erased for the power outage duration.	Verify and adjust the time if needed. See *Time Clock Setting* section on page 14.
Adv 7	The system has restarted after a power outage lasting between 2 and 36 hours.		
Adv 8	The system has restarted after a long power outage of more than 36 hours.	At power on, the time is displayed. For a long power outage, it is most likely that time adjustment is needed. Message disappears when the time clock is adjusted. The 24 hours log has been totally erased.	Adjust the time clock since data have been lost due to the long power outage which has drawn all current from the rechargeable backup battery. See *Time Clock Setting* section on page 14.
CF	Cyclical fan is on for the set duration	The "CF" message displays telling the cyclical fan is ON. The CO_2 enrichment should be OFF	The "CF" message will disappear when the set cyclical ventilation time is up.
FCrH	The Fan Control kicked in because the relative humidity is too high	The FCrH displays alternately with the selected sensor measured value. . The CO_2 enrichment should be OFF	User choice or dehumidifier is not working or is not sufficient to remove excess humidity.
FC T	The Fan Control kicked in because the temperature is too high	The FC T displays alternately with the selected sensor measured value. . The CO_2 enrichment should be OFF	User choice or cooling equipment is not working or is not sufficient to lower temperature

ERROR MESSAGES

Code	Cause	Solution
Err 1	A key from the keyboard is pressed at power up.	If a key is stuck in, call technical support at 1 888 577-6274.
Err 3	CO_2 sensor is defective.	Disconnect and reconnect the controller or do a reset. See *Reset Procedure* at the end of this section. If the problem persists, call technical support at 1 888 577-6274.
Err 4	Temperature/humidity sensor is defective.	
Err 6	Automatic recovery has failed after intermittent fault.	

ALARM MESSAGES

Code	Cause	Effect on controller	Solution
Alr 1	Relative humidity's low limit has been reached.	The message disappears once the conditions return between the limits set by the user. The alarm's dry contact is activated.	Verify room conditions or adjust the alarm's limits. See sections *Alarm – Temperature's high and low limits adjustment* and *Alarm – Relative humidity's high and low limits adjustment* on pages 11 and 13.
Alr 2	Relative humidity's high limit has been reached.		
Alr 3	Temperature's low limit has been reached.		
Alr 4	Temperature's high limit has been reached.		

RESET PROCEDURE

To reset the controller to factory default settings, follow the steps below:

- Disconnect the Ethernet cable (RJ45) from the connector located underneath the control module iGS-221.
- Simultaneously press the UP and DOWN ARROWS and keep pressed while reconnecting the Ethernet cable.
- Wait until 3 horizontal lines (≡≡≡≡) appear on the display (about 5 seconds) before releasing the ARROW keys.
- The controller will restart: all settings are restored except altitude, time and the 24 hours log.

Reset does not affect the CO_2 sensor's calibration.

6. SENSORS CALIBRATION

The iGS-221 includes 3 climate sensors: one for the CO_2, a second one for temperature and a third one for relative humidity. Each of them can be independently calibrated without affecting the others.

CO_2 SENSOR CALIBRATION

Do you need to calibrate the CO_2 sensor?

The CO_2 sensor is normally factory calibrated for a 1 to 5 years period. **However, we recommended that you verify the accuracy of the calibration when purchasing a controller** since CO_2 sensors are fragile and subject to important measurement variations. A simple shock, in transportation or at the installation, is enough to make the sensor's reading slip away from the true value. From our experience, we recommend to calibrate NDIR CO_2 sensors before each crop or every three months to offer your plants the best possible growing conditions. The CO_2 sensor's calibration must be done at least once a year. The iGS-221 has a build-in timer that will inform that a calibration is needed after one year of use by displaying "Adv2". For more information, see *Displayed Messages and Solutions* section on page 21.

DIFFERENT CALIBRATION METHODS

Calibration kit for CO_2 sensors

The ideal calibration method is to expose the controller to a known and certified CO_2 gas mix. Place the controller in an airtight bag to protect it against human breathing (around 40 000 ppm!), remove the air from the bag and replace it with a known CO_2 concentration mix. Then, just follow the calibration instructions (see below). Remember that a CO_2 sensor will be inaccurate at its measurement scale limits, for example around 0 and 5000 ppm. To obtain a calibration as precise as possible, the ideal way is to calibrate the controller with a gas mix that has a concentration close to the one desired in the garden (around 1000 ppm).

Some retailers offer, at an affordable price, a calibration service using this precise and reliable method. According to the number of calibration to make and frequency, it might be worthwhile to get a PLUG'N'GROW calibration kit. For more information, go visit our web site (n**ovabiomatique.com**).

Comparison with a reference

Another calibration method is to compare the controller's measurement with a **reliable** measuring device. However, one has to insure that the reading is as stable as possible throughout the procedure. We recommend isolating the controller and the measuring device in a protected environment against human breathing, in a sealed translucent bag for example.

Outdoor calibration

For lack of using the two methods above, you can calibrate your CO_2 sensor outdoor, but take note that this method is not precise. We suppose an average exterior air CO_2 concentration of 400 ppm. However, depending on the location and the time of the day, the real CO_2 concentration in the air is between 350 and many thousands ppm. Be assured to choose a non polluted environment with a temperature similar to the garden's temperature; a wide variation between the outdoor temperature and the garden's temperature will falsify the controller's calibration. Do not calibrate under the freezing point temperature.

It is not recommended to practice this method of calibration indoor.

CALIBRATION PROCEDURE

Before beginning the calibration process, be sure that the controller's reading is stable (this might take a few minutes). If the controller is not isolated (e.g.: sea-led bag) during the calibration, avoid breathing nearby. (When calibration is done outside, do not put the controller in a bag so it breathes fresh air.)

- Repeatedly press SELECT SENSOR key until [ppm CO_2] light indicator is on.
- Repeatedly press MODIFY key until all light indicators are off in the functions menu.
- Press UP ARROW and DOWN ARROW alternately 5 times within 5 seconds (up/down, up/down...); the display shows "CO2" and "CAL" alternately.

- Press SELECT SENSOR key to continue to the next step. To abort the calibration at any time, press MODIFY.
- The display shows the ambient CO_2 concentration alternately with "CAL". Press the ARROW keys to modify the current value accordingly to the calibration method used:

  - o Calibration kit: adjust the value to the known and certified gas mix concentration.
  - o Comparison with a reference: adjust the CO_2 concentration with the one measured on the reference.
  - o Outdoor: adjust CO_2 concentration to 400 ppm.
- Press SELECT SENSOR to continue to next step.
- The display shows "CAL" and "run" alternately to indicate that the calibration is in progress. It may take up to 8 minutes before the calibration is finished. Important: Do not interrupt calibration at this point.

- When the calibration is completed, the display shows "CAL" and "Done" alternately.

- Press any key to exit. The controller will restart and it will take approximately 30 seconds before getting a measurement.

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RELATIVE HUMIDITY AND TEMPERATURE SENSORS CALIBRATION

Do you need to calibrate your relative humidity or temperature sensors?

Relative humidity and temperature sensors are **factory calibrated**. They are built to preserve their precision for their lifetime. **We recommend not to calibrate these sensors,** even if it is possible to do so without damaging them. In general, these sensors require calibration only if you wish that two separate controllers display the same reading. Calibrating these sensors means **adding or subtracting an offset** between the parameter real value and the displayed value. This offset is memorised in the controller until the next calibration or reset. The reset allows to return to factory default settings (see page 22 for Reset procedure).

CALIBRATION PROCEDURE

Before beginning, make sure to use a reliable measuring device (thermometer or precision hygrometer) that will become your **reference** for this calibration.

- Repeatedly press SELECT SENSOR key until [% RH] or [Temp °C/°F] light indicator is on, depending on the sensor you wish to calibrate.
- Repeatedly press MODIFY key until all light indicators are off in the functions menu.
- Press UP ARROW and DOWN ARROW alternately 5 times within 5 seconds (up/down, up/down...); the display shows “CAL” and “rh” alternately for the relative humidity sensor, or “CELS” (“FAHr” if programmed in Fahrenheit) and “CAL” for the temperature sensor.
- Press SELECT SENSOR to continue to the next step. Press MODIFY to abort the calibration at any time.
- The display shows “CAL” and a numerical value alternately corresponding to the relative humidity or temperature measured from the sensor. Press the UP or DOWN ARROW key to adjust the value according to the one measured from your reference.
- Press SELECT SENSOR to continue to the next step.
- When the calibration is completed, the display shows “CAL” and “Done” alternately.
- Press any key to exit. The controller will restart.

7. SECURITY AND MAINTENANCE

AIR FILTER

The controller is equipped with an internal fan that allows a faster air sampling. Do not expose the venting slits to potential sources of humidity or dust. These slits located under the control module are protected by a dust guard filter that should be there at all times. We recommend to regularly clean or replace the dust guard filter to improve the controller's effectiveness and its length of life.

To remove the filter, lift up the black plastic cover. Be careful to keep the screen located inside. Place the screen back in the black cover and place the new or cleaned filter on the screen. Place the cover back.

SULPHUR EVAPORATION

The use of evaporated sulphur damages the CO_2 sensor. The controller should be disconnected and protected in a sealed packaging during sulphur evaporation.

WATER SPLASHING

Do not direct a water jet towards the iGS-221 control module, the connection module as well as the iGS-25. These enclosures can withstand light splashing but should not be drenched with water to protect the sensors and the internal circuitry, and to prevent possible electrical hazards.

CAUTION	THE EQUIPMENT(S) PLUGGED TO THE IGS-25 OUTLETS AND CONTROLLED BY THE IGS-221 MUST HAVE THEIR OWN OVERHEATING PROTECTION BREAKER OR APPROPRIATE DEVICE

ELECTRICAL SPECIFICATIONS

IMPORTANT: Each iGS-25 can support a maximum of 15 A. In order to take advantage of 15 A for each iGS-25, **it is important to use 3 electrical outputs on 3 separate electrical circuits**. The equipments' total load must not exceed the electrical circuit capacity.

Control module iGS-221		
Input power	12 Vdc @ 600 mA	
Internal fan	Magnetic levitation sleeve bearing, 7 cfm	
CO_2 sensor range	0 to 5000 ppm	
CO_2 sensor precision	+/- 75 ppm	
CO_2 sensor calibration	Factory calibrated; user calibrated once a year. See page 23.	
Temperature sensor range	-20 °C to +50 °C or -4 °F à +122 °F. To change units, see page 12.	
Temperature sensor precision	+/- 1 °C or +/- 2 °F	
Temperature sensor calibration	Factory calibrated, 5 years minimum, see page 25.	
RH sensor range	0 to 100 % relative humidity (RH)	
RH sensor precision	+/- 3,5 % (RH)	
RH sensor calibration	Factory calibrated, 3 years minimum, see page 25.	
Front panel	Splash proof keyboard membrane	
Alarm dry contact	N.O or N.C., fail safe or standard, 0.6 A @ 120 Vac or 2A @ 30 Vdc	
Operating temperature	0 to 60 °C, 0 to 95 % non-condensing RH.	
iGS-25		
Input	120 V – 60 Hz – 15 A	
Output voltage	120 V – 60 Hz	
Output maximum current	**Load type**	**Rating**
	General purpose	15 A total for both receptacles*
	Resistive	15 A total for both receptacles*
	Motor	½ HP total for both receptacles *
AC adapter		
Power Supplied	12V DC center positive 800 mA min	

*For iGS-221, equipments plugged in on a same iGS-25 act in opposite ways and iGS-221 will not activate them at the same time, so a maximum load of 15 A for each iGS-25's plug.

CAUTION	THE EQUIPMENT(S) PLUGGED TO THE IGS-25 OUTLETS AND CONTROLLED BY THE IGS-221 MUST HAVE THEIR OWN OVERHEATING PROTECTION BREAKER OR APPROPRIATE DEVICE

8. WARRANTY

Nova Biomatique, Inc. (hereafter NBI) offers a 3 year warranty from the date of original purchase by the end-user (**proof of purchase required**), applicable to defects in material and workmanship for the control module (iGS-221), the connection module and the iGS-25. All guarantee claims must be submitted directly to NBI by the retailer or end-user (1 888 577-6274). The warranty only applies to new products purchased from an authorised store or wholesaler (not applicable on used products sold on the Internet). The warranty is limited to the repair or replacement of any defective part of the product covered by warranty upon NBI's technical support appraisal. The warranty **does not cover the followings**: defects resulting from shipping (insurance is recommended), customers' installation, improper or abusive uses, excessive wear, negligence or non authorized tampering.

Distributors, dealers or other sales representatives in partnership with NBI are prohibited from adding or deleting items from this warranty coverage. For any questions related to your warranty, call PLUG'N'GROW (1 888-577-6274) customer service representatives.

Shipping fees are the customer's responsibility, except for replacements or repairs covered by the warranty, where NBI will only assume the return standard ground shipping fees.

STEP-BY-STEP WARRANTY AND REPAIRS IMPLEMENTATION

1. All end-users and retailers **please call first the PLUG'N'GROW toll-free technical support**: 1 888 577-6274.
2. Over the phone, we will quickly investigate the problem and decide if the product needs repairs or replacement.
3. We will need the serial number, the product's date of purchase of the product, the store name from which it was purchased from and an accurate description of the problem.
4. If the product needs to be replaced, the retail store will give the end-user a brand new one as soon as we issue an authorization number, which will be faxed or emailed to the retailer.
5. If it has to be repaired under warranty, we also need to give an authorization number though our technical support service, then the product can be shipped to our facilities by the retailers' store (shipping cost at your charge).
6. If the end-user sends us a product for repair, which is not under warranty, and declines that the product be repaired at the estimated costs, he will be charged $50.00 plus shipping fees. We will return the defective unit without repairs.
7. All repaired and replaced products under warranty returned to retailers and/or end-users will be shipped standard ground or, if paid by the customer, using a faster delivery service.

Toll Free Technical Support: 1 888 577-6274 or email tech@igrowing.ca

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La Pocatière (QC) Canada G0R 1Z0

novabiomatique.com

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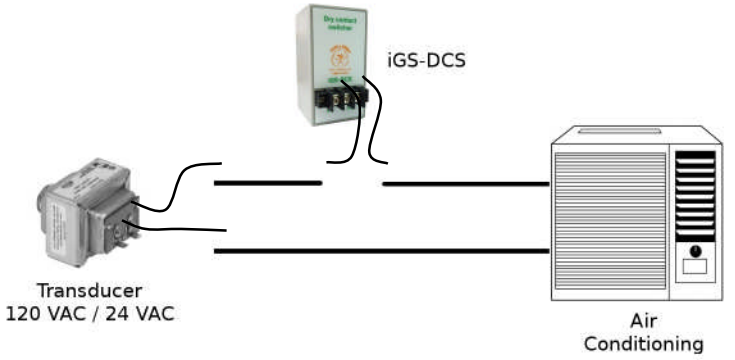
THE IGS-DCS - DRY CONTACT SWITCHER

The iGS-DCS is a switch relay that operates from a standard 110-120V electrical output. It activates a control loop that can operate air conditioning unit, heat pump, ventilators, humidifier, dehumidifier or “2 wires” devices connected to a less than 90V ac circuit or a 24V dc circuit. The iGS-DCS, when connected to a 110-120V climate controller’s output, replaces any thermostat or hygrometer equipped with “2 wires”. These “2 wires” once removed from the thermostat or hygrostat can be reassigned to the iGS-DCS’ electric screw terminals. Then, plugged into the proper controller’s activated output, the iGS-DCS relay will connect both electric terminals and enable the equipment. Please note that it may be necessary to use an extension cord to avoid hindering other controller’s output.



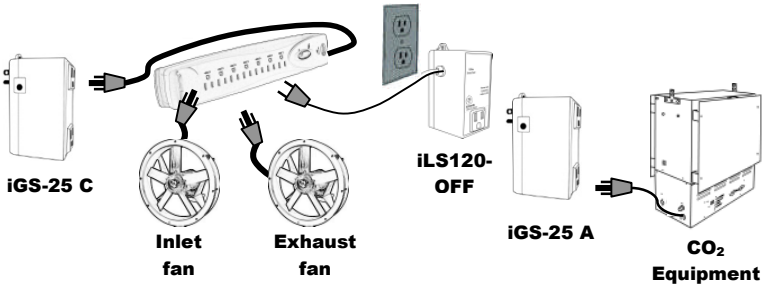
LE ILS120-OFF

Multi-circuit OFF Switcher Relay 120 V

Features

- Switches OFF when sense cord is powered or the opposite
- **Used to inhibit CO_2 while venting is in progress**
- 120 V, 15 A, 2 HP load capacity

How to use the iLS120-OFF for venting with the iGS-221's C2 output
Plug a 120 V power strip in the outlet 2 of the iGS-25 C and plug the venting equipment and the iLS120-OFF sense cord in the power strip. Plug the iLS120-OFF in a 120 V separate circuit and plug the iGS-25 A in the iLS120-OFF outlet. Finally, plug the CO_2 enrichment device in the outlet 1 of the iGS-25 A.



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OTHER PLUG'N'GROW PRODUCTS

CO_2 SENSOR CALIBRATION KIT

***Simple**, **fast** and the **most reliable** method in the indoor gardening market!*

The calibration: essential for precision
NDIR CO_2 sensors loose their calibration easily as time goes by or if submitted to a shock. This is why it's recommended to regularly calibrate them for a **precise control without wasting the CO_2** offered to the plants!

Why a calibration kit?

- A calibration performed outdoor or with another reference is not precise and risks to falsify even more the sensor's measurements.
- The PLUG'N'GROW calibration kit includes a 1000 ppm certified gas for a precise CO2 concentration for the calibration.

Ideal for "in store" calibration service!
Effective on any controller's make and model!
A kit provides at least 20 calibrations!

HEAVY DUTY LIQUID CO_2 REGULATOR!

To enrich your garden with CO_2 without generating heat

- CO_2 flow **up to 50 SCFH**; 2.5 to 3 times the maximum flow offered by competing products
- Ideal for grow rooms from 650 to 7500 cubic feet
- Features a heater to avoid regulator and valve freezing at high CO2 flow
- Includes an **industrial solenoid valve from ASCO™**, North American made continuous duty, 20 000 000 cycles life expectancy
- Works with any CO_2 controller with a standard 110-120 V, 3 prongs outlet
- Standard connection for CO_2 bottle and possibility to connect to multiple bottles
- Reliable and long lasting, covered by **PLUG'N'GROW's 3 years warranty**

For more details, please visit **novabiomatique.com**
or call us at **1 888 577-6274**